

10/21/16

"One finds limits by pushing them." -Herbert Simon

2, 4, 10, 11, 13

HW: "Multiplying and Dividing Rational Expressions" worksheet #2-16 even

AIM: How do we Multiply or Divide Rational Expressions?

Warm Up:

1) Simplify

$$\frac{(x-1)}{(1-x)} = -1$$

This works b/c

$$\frac{(x-1)}{(1-x)} = \frac{(x-1)}{-1(x-1)} = -1$$

⊗ When we have factors that have the same two terms separated by subtraction but in reverse order, we can cancel both of them and replace one of them with -1.

## Simply Put:

The rule for multiplying algebraic fractions is the same as the rule for multiplying numerical fractions.

Multiply the tops (*numerators*)

AND

multiply the bottoms (*denominators*).

"RATIONAL  
EXPRESSIONS"

STRAIGHT  
ACROSS

MIT



If possible, reduce (cancel) **BEFORE** you multiply the tops and bottoms!

(It's easier than simplifying at the end!)

Remember to factor  
first if possible.

Factor everything  
that can be factored.

**⊗ FACTOR FIRST**

$$1) \quad \frac{2a^2}{5b} \cdot \frac{15b^3}{4a^2} = \frac{\cancel{2}^1 \cancel{a^2}^3 \cancel{15}^3 \cancel{b}^2}{\cancel{5}^1 \cancel{4}^2} = \boxed{\frac{3b^2}{2}}$$

restrictions:

$$\begin{array}{ll} 5b \neq 0 & 4a^2 \neq 0 \\ b \neq 0 & a \neq 0 \end{array}$$

$$3) \quad \frac{x(x-1)}{x^2-x} \cdot \frac{(x-2)(x+1)}{x^2-1} = \frac{\cancel{x} \cancel{(x-1)} \cancel{(x-2)} \cancel{(x+1)}}{3 \cancel{x} \cancel{(x+1)} \cancel{(x-1)}} = \frac{x-2}{3}$$

$(x+1)(x-1)$

restrictions:

$$\begin{array}{ll} 3x \neq 0 & (x+1)(x-1) \neq 0 \\ x \neq 0 & x \neq -1 \mid x \neq 1 \end{array}$$

$$= \boxed{\frac{x-2}{3}} \quad \frac{100-2}{3} = \boxed{\frac{98}{3}}$$

$$5) \quad \frac{2(x+4)}{3} \cdot \frac{6x^2}{4x+16} = \frac{\cancel{2} \cancel{(x+4)}^2 \cancel{6}^1 \cancel{x^2}^2}{3 \cdot \cancel{4}^2 \cancel{(x+4)}} = \frac{x^2}{1} = \boxed{x^2}$$

rest:

$$\begin{array}{l} x+4 \neq 0 \\ x \neq -4 \end{array}$$

**Simply Put:**

The rule for dividing algebraic fractions  
is the same as the rule for dividing numerical fractions.

Change the division sign to multiplication,  
flip the 2<sup>nd</sup> fraction ONLY,  
and then follow the steps for "multiplying rational expressions".

7) 
$$\frac{(x-4)(x-1)}{x^2-5x+4} \div \frac{(x-4)(x+4)}{x^2-16} = \frac{(x-4)(x-1)}{3x} \cdot \frac{4}{12x} \cdot \frac{1}{(x+4)(x-4)}$$

rest:

$$\begin{array}{ll} 3x \neq 0 & 12x \neq 0 \\ x \neq 0 & x \neq 0 \end{array}$$

$$\begin{array}{ll} x+4 \neq 0 & x-4 \neq 0 \\ x \neq -4 & x \neq 4 \end{array}$$

$$= \frac{(x-1)(4)}{(x+4)} = \boxed{\frac{4x-4}{x+4}}$$

9) 
$$\frac{(c-6)(c+4)}{c^2-2c-24} \div \frac{(c+6)(c-6)}{c^2-36}$$

$$\frac{c(c+4)}{c^2+4c} \div \frac{(c+6)(c-6)}{6+c}$$

restrictions:

$$\frac{c(c+4) \neq 0}{c \neq 0 \mid c \neq -4}$$

$$\frac{(c+6)(c-6) \neq 0}{c \neq -6 \mid c \neq 6}$$

$$\frac{6+c \neq 0}{-6 \mid -6} \\ c \neq -6$$

simplify:

$$\frac{(c-6)(c+4)}{c(c+4)} \cdot \frac{6+c}{(c+6)(c-6)} = \boxed{\frac{1}{c}}$$

⊗ For Division:

Check the numerator AND Denominator  
of the fraction we are dividing by  
for restrictions.

$$6) \frac{x-2}{3x+3} \div \frac{x(x+2)}{x^2+2x} = \frac{x-2}{3(x+1)} \cdot \frac{\cancel{x+2}}{\cancel{x(x+2)}} = \frac{x-2}{3x(x+1)}$$

$$= \boxed{\frac{x-2}{3x^2+3x}}$$

restrictions:  $x \neq -2, -1, 0$

$$\frac{3(x+1) \neq 0}{3 \neq 0 \mid x \neq -1} \quad \frac{x(x+2) \neq 0}{x \neq 0 \mid x \neq -2}$$

$$x+2 \neq 0 \\ x \neq -2$$

$$12) \frac{(x+1)(x+1)}{(x+1)^2} \div \frac{3(x+1)}{3x+3}$$

$$\frac{x^2-6x+9}{(x-3)(x-3)} \div \frac{x-3}{x-3}$$

rest:

$$x \neq 3$$

$$x \neq -1$$

$$x \neq 3$$

$$\frac{(x+1)\cancel{(x+1)}}{(x-3)\cancel{(x-3)}} \cdot \frac{\cancel{x-3}}{\cancel{3(x+1)}} = \frac{x+1}{3(x-3)} = \boxed{\frac{x+1}{3x-9}}$$